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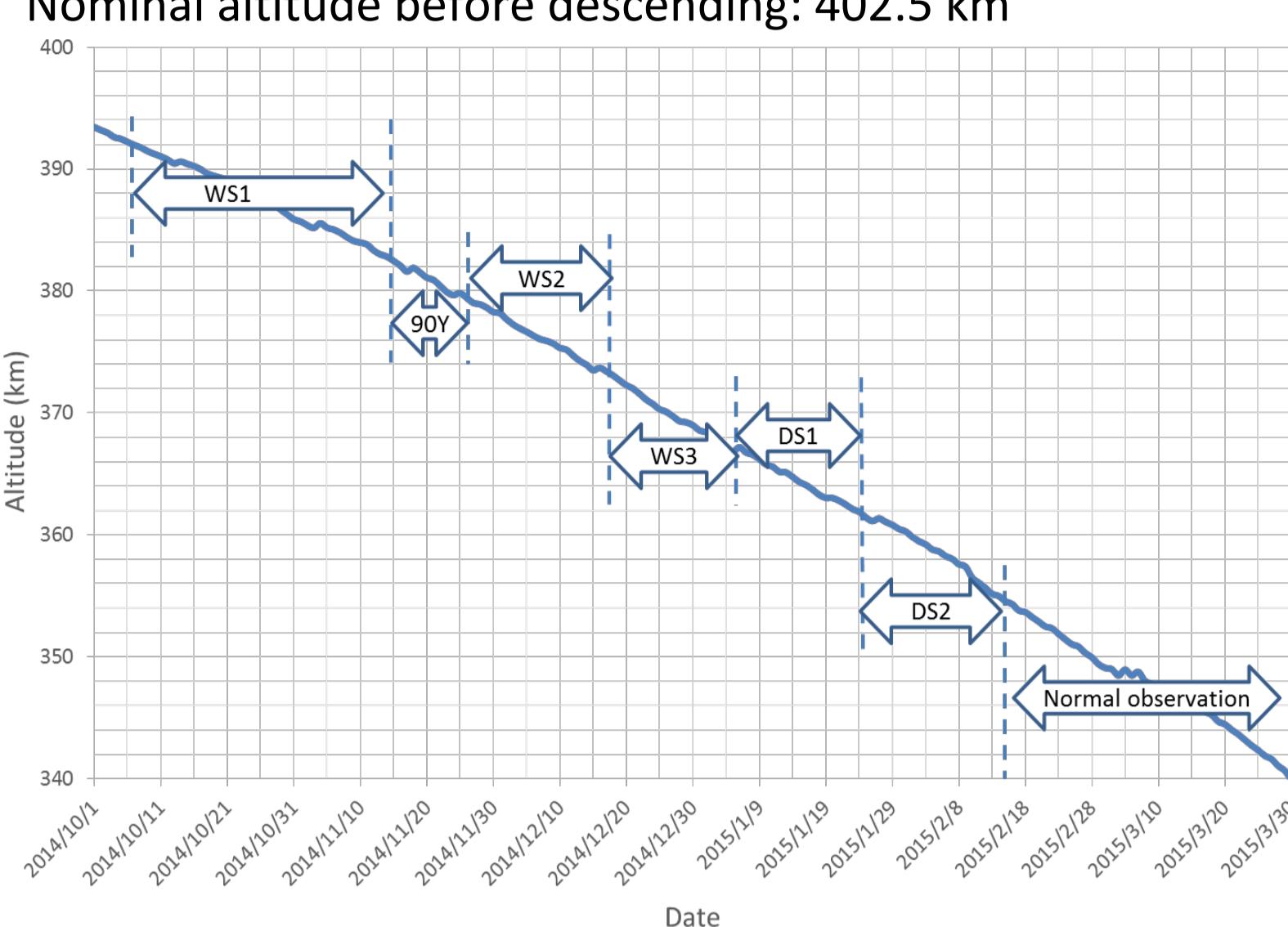
(Institute for Space-Earth Environmental Research, ISEE, Nagoya U.)

Introduction: TRMM end of mission (EOM) Experiment

- TRMM satellite started to descend in June 2014 because of no fuel remained to maintain the satellite altitude.
- During the descent, special experiments of the Precipitation Radar were implemented.
 - wide swath (WS1, 2, and 3) --- Nov. to Dec., 2014 (1.5 months)
 - 90-degree yaw maneuver (90Y) --- 11 days, from Nov. 15 to 25, 2014.
 - day side of orbit and the US day time only: 80 min./day
 - Total 880 minutes of data
 - dense sampling (DS1 and 2) --- Jan. 5 to Feb. 12, 2015
- PR stopped operation on 31st March, 2015.

Experimental schedule and satellite altitude

Nominal altitude before descending: 402.5 km



TRMM/PR data sampling (constraints for range/angle bin settings):

- > 49 angle bins for one scan (angle bin #25 = nadir)
- > fixed onboard sampling range (50 km window)
- > successive 35 km range data are downlinked

> Full rain data cannot be observed at nadir direction

- > sparse observation at near nadir

Nominal sample area

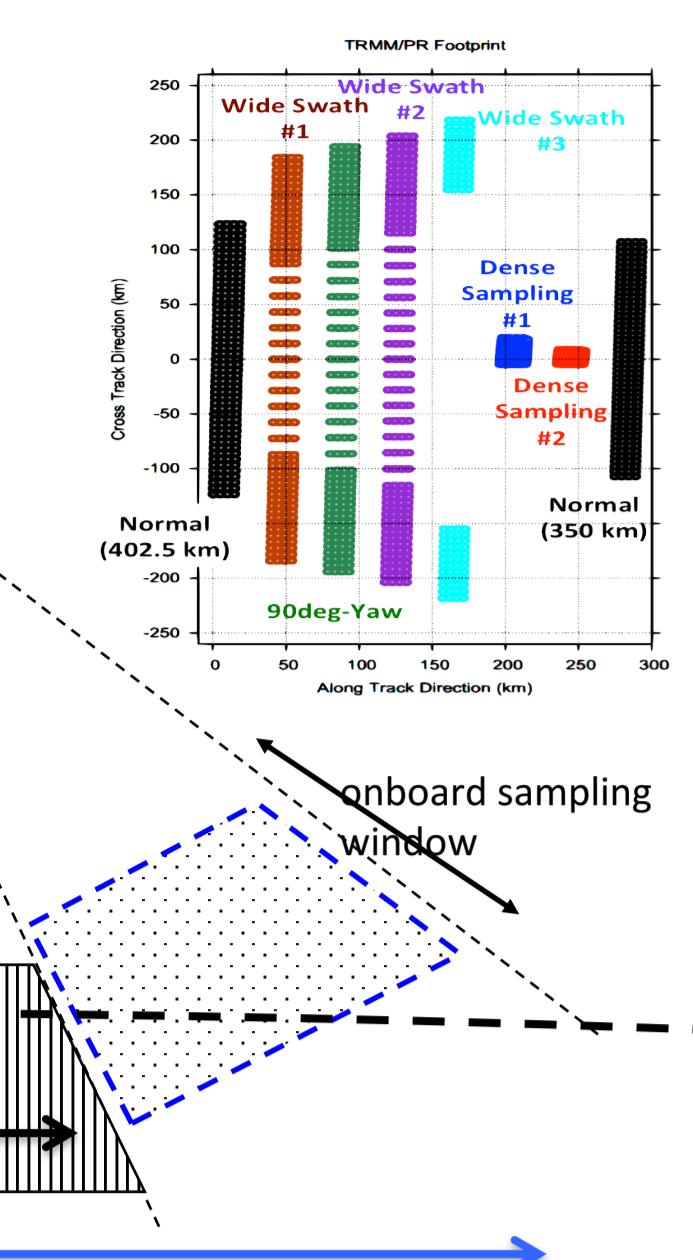
Sample area of wide swath experiment

Earth's surface (about 380 km)

Earth's surface (402.5 or 350 km)

about 240 km

about 400 km



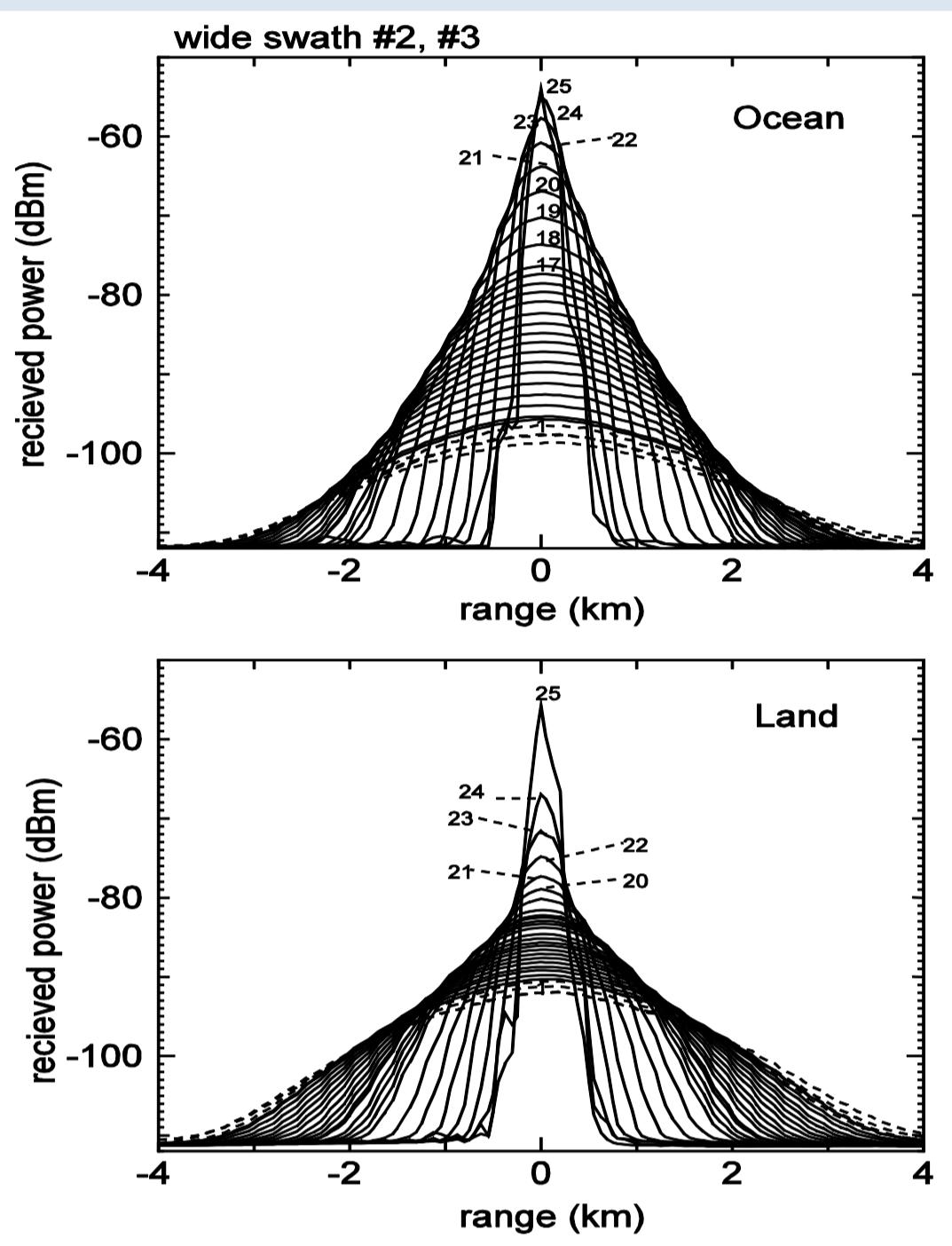
wide swath experiments (#1, 2, and 3)

purpose

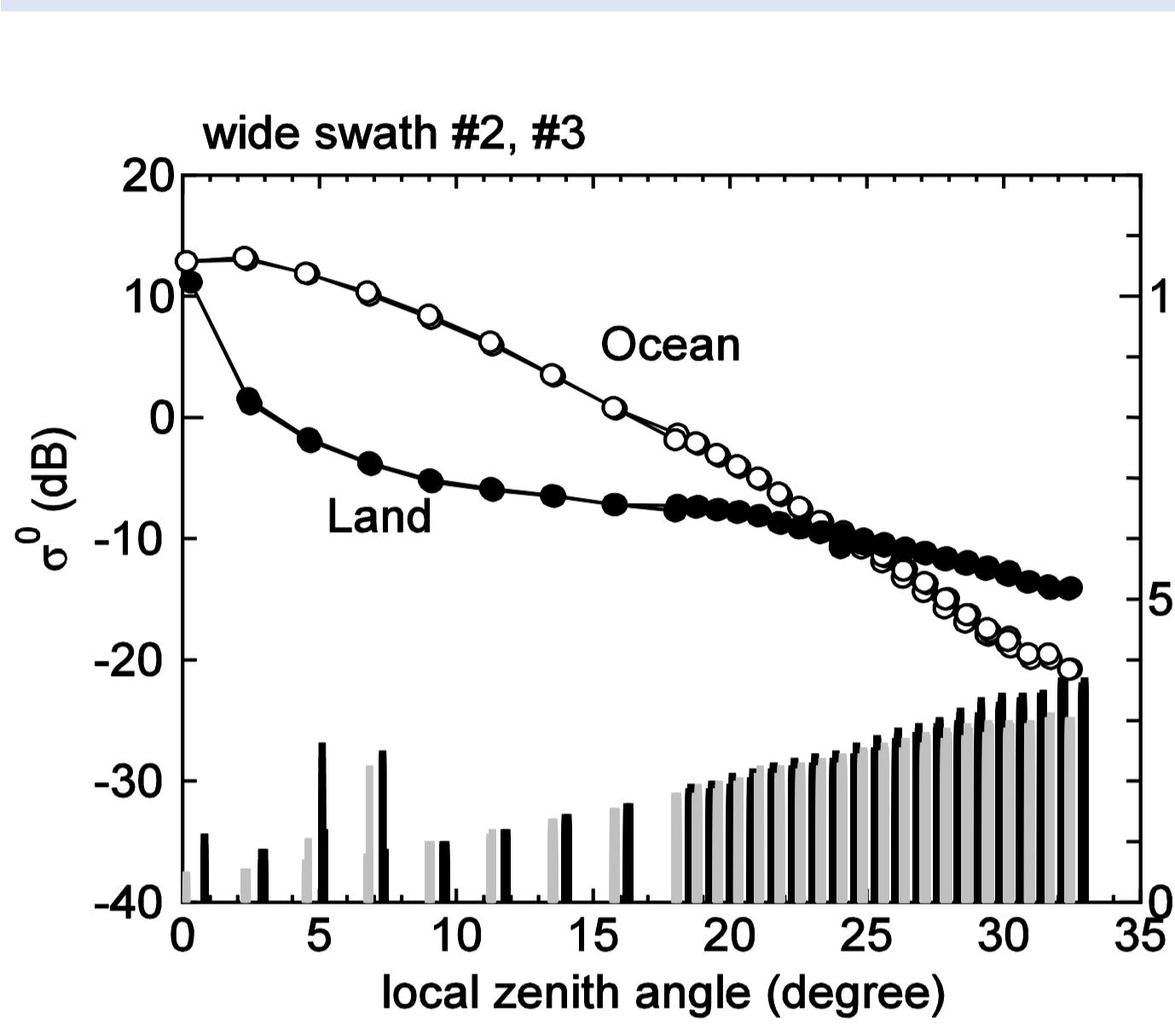
To design the future wide-swath spaceborne radar

- > Peak surface echo for wide angles.
- > To see the average sigma zero for wide angles
- > To see the possible rain bottom (clutter height) for wide swath operation.

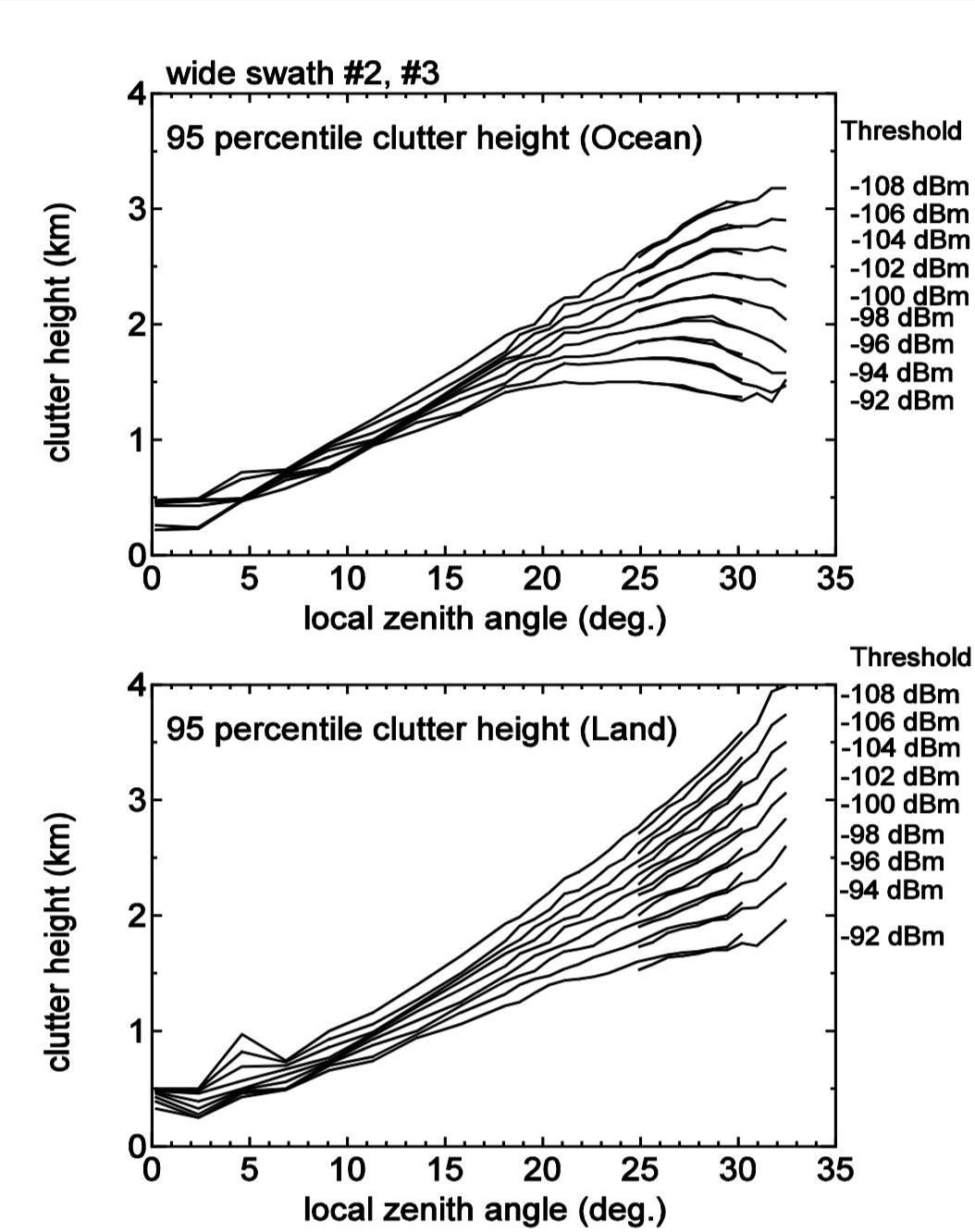
surface echo profile



sigma-zero vs. local zenith angle



Clutter height

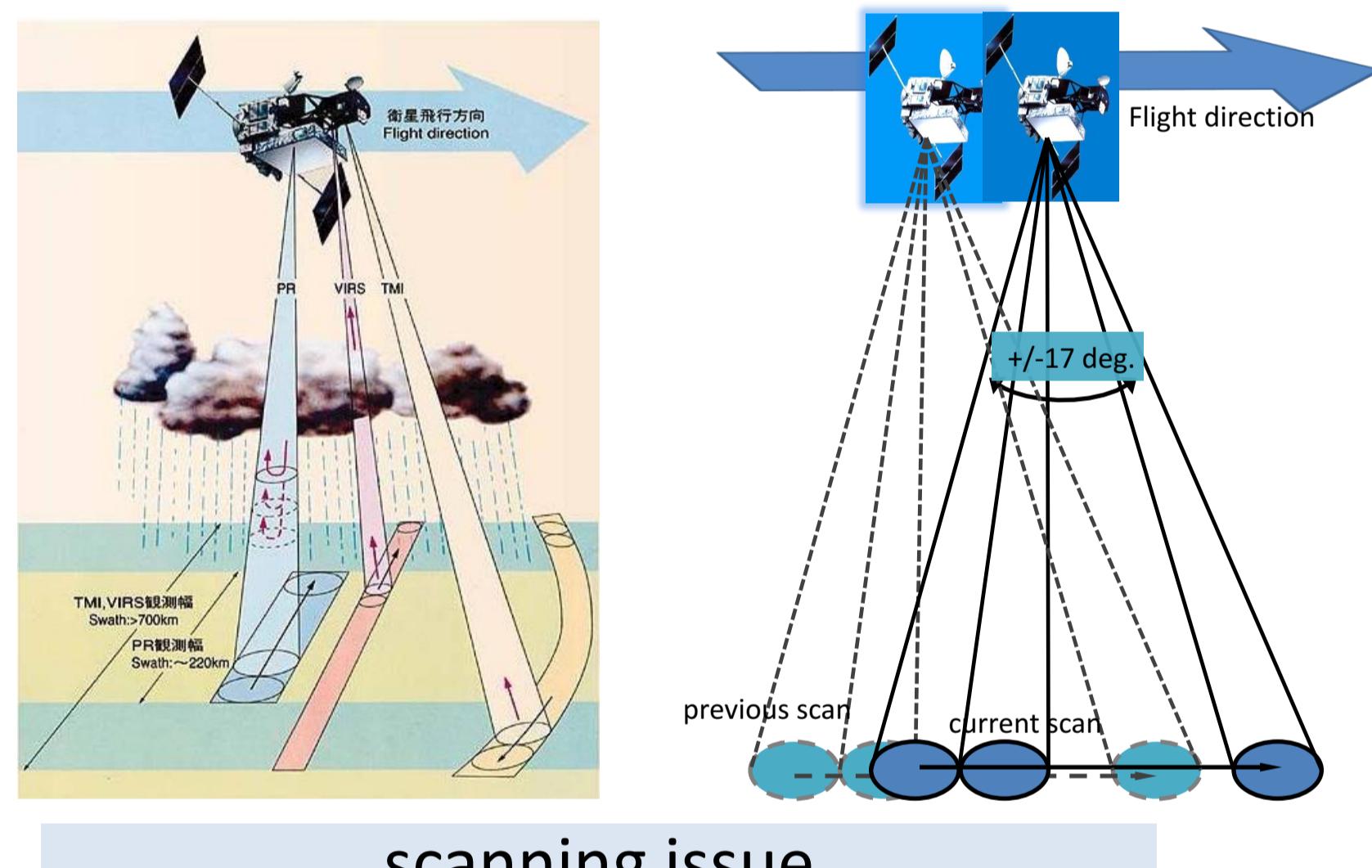


90 degree yaw experiment

concept of the experiment

Rotate the satellite by 90 degrees to realize dense along track scan.

Nominal observation(cross-track scan) 90 deg yaw (along-track scan)

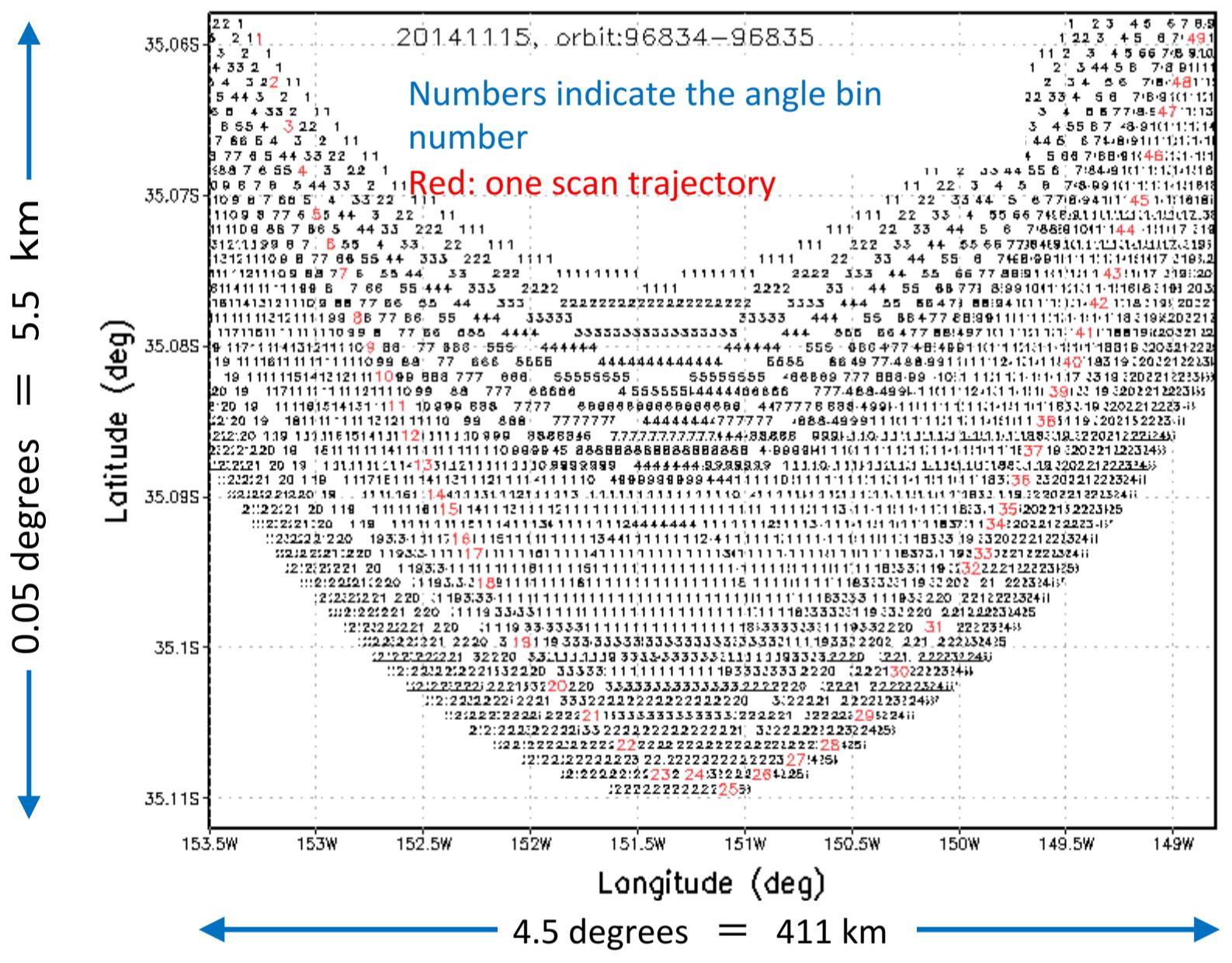


scanning issue

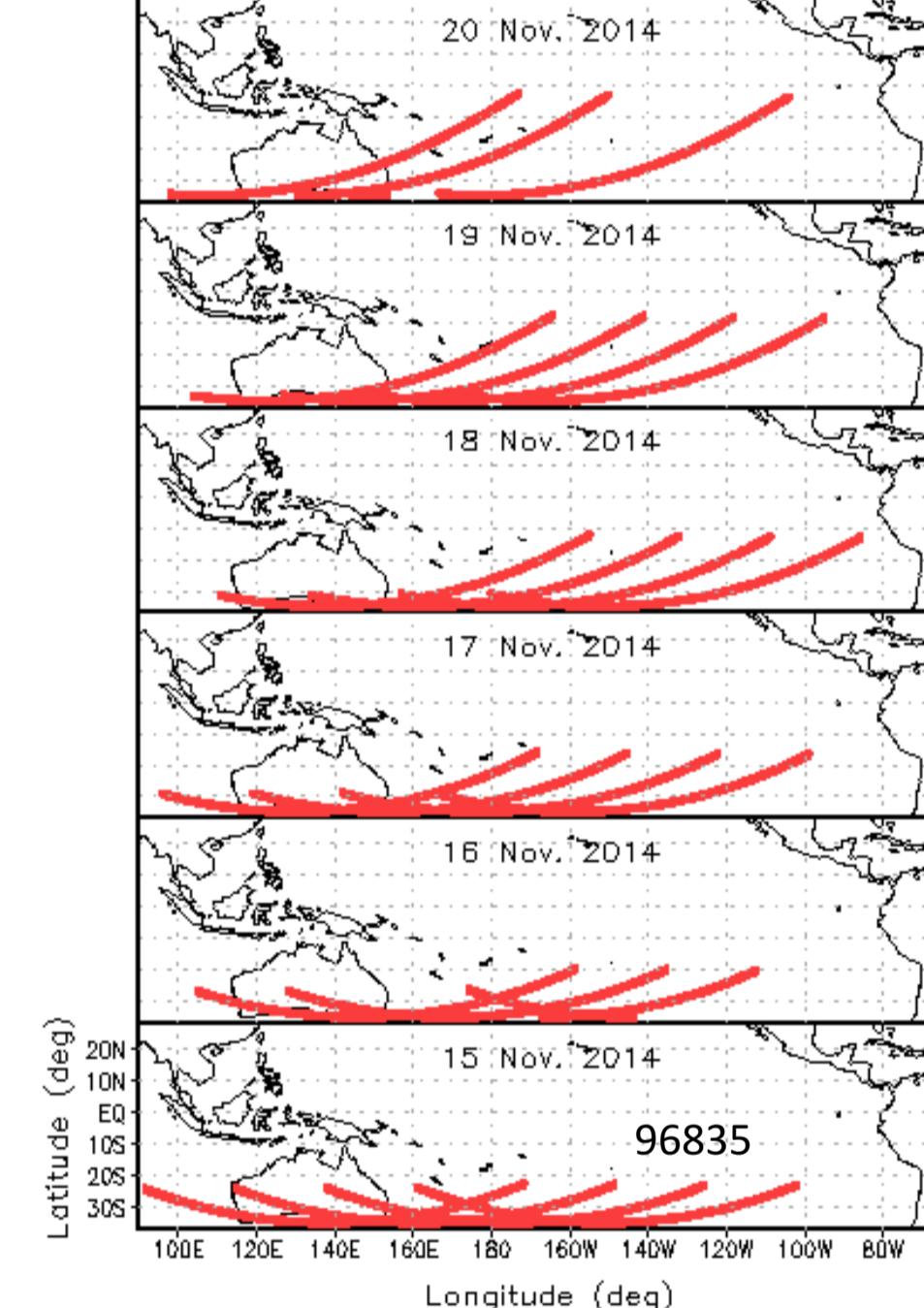
- 90-deg. yaw observation is not perfect linear observation.
 - Conical scan of PR (antenna tilted mechanically by 4°)
 - Earth's rotation effect during scans

conical scan of PR

footprint trajectory (90Y) @35S



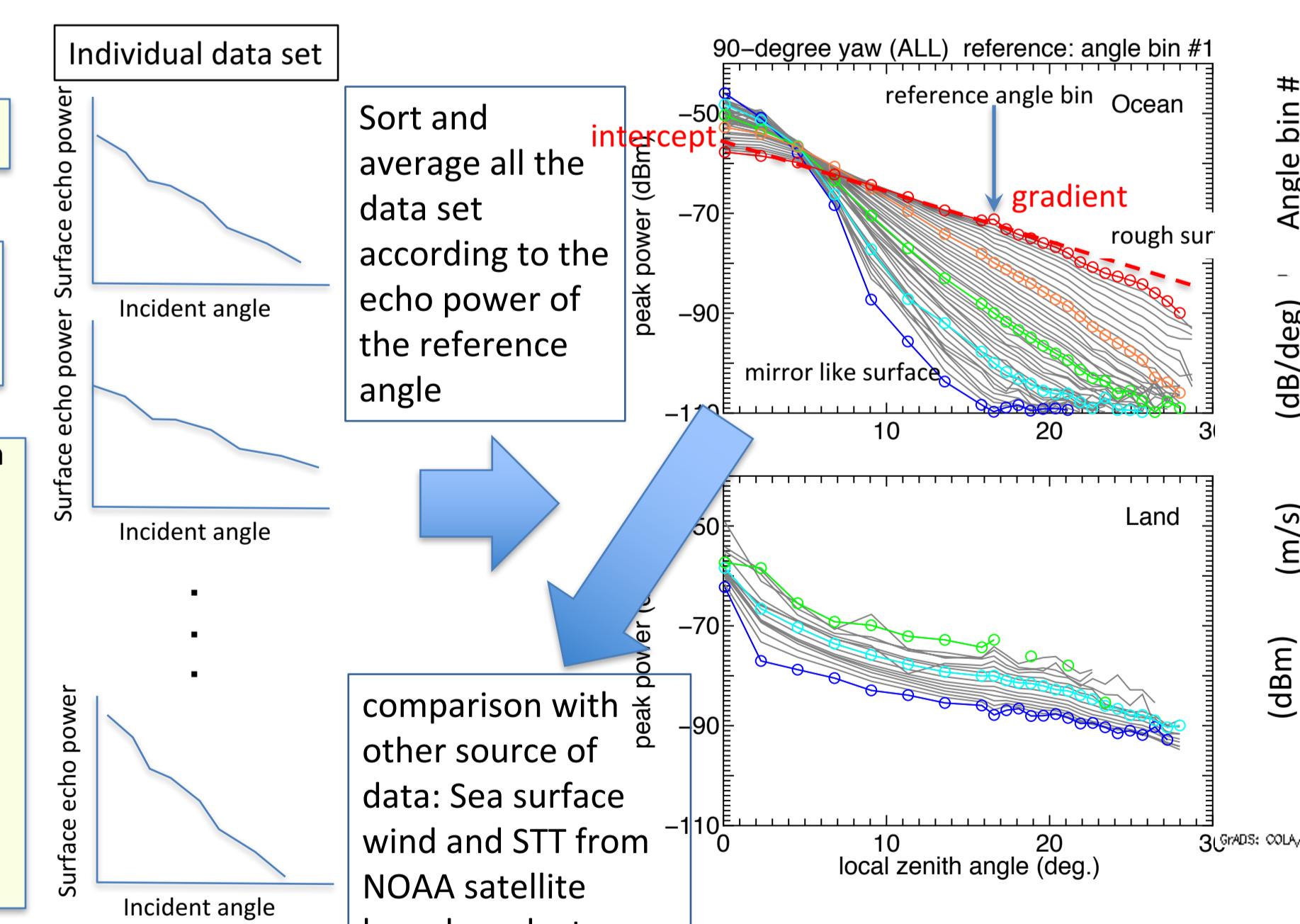
experimental area



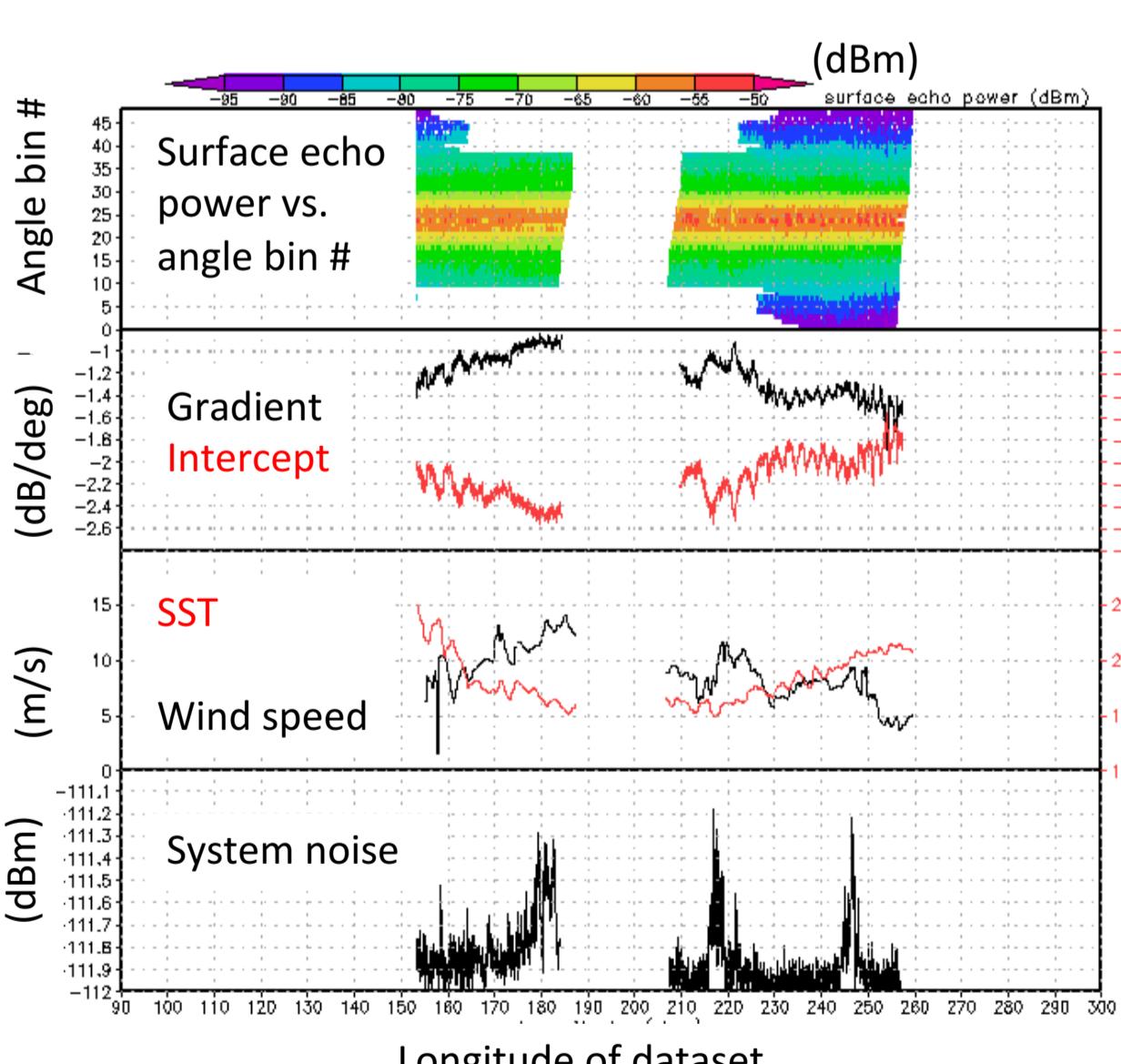
90-degree Yaw (Nov. 2014)

analysis procedure: dataset creation

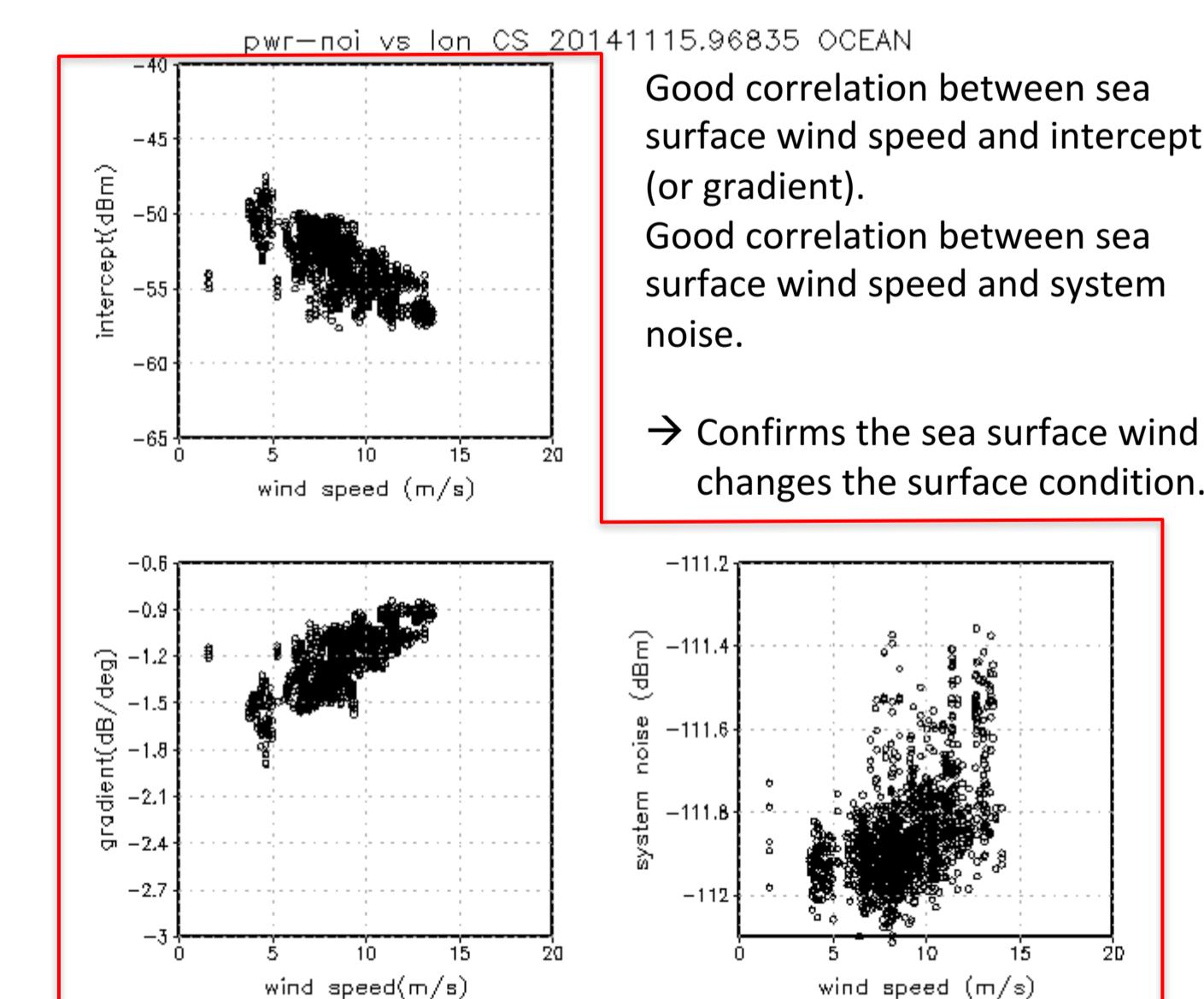
angle bin dependency of surface echo



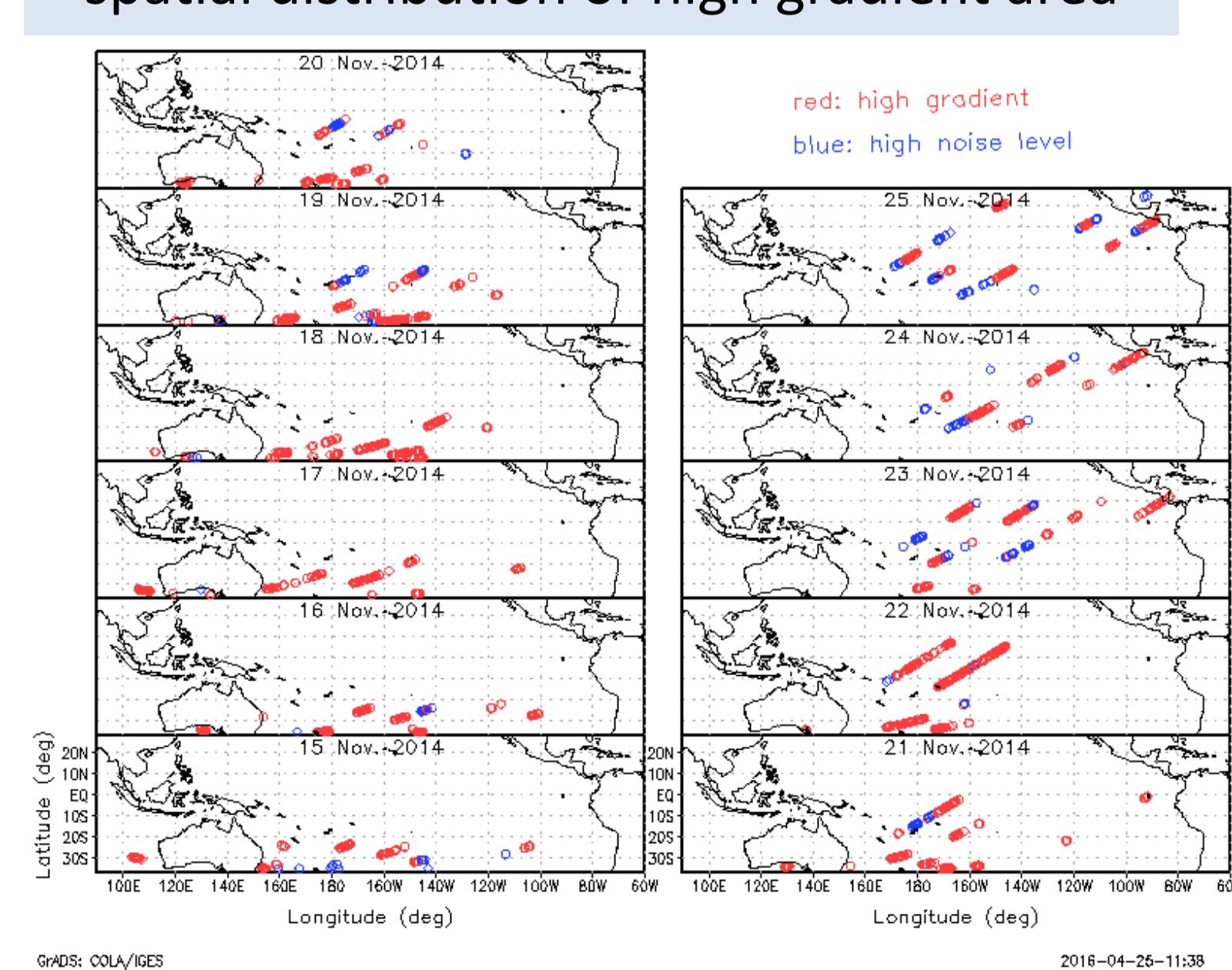
case study: orbit #96835



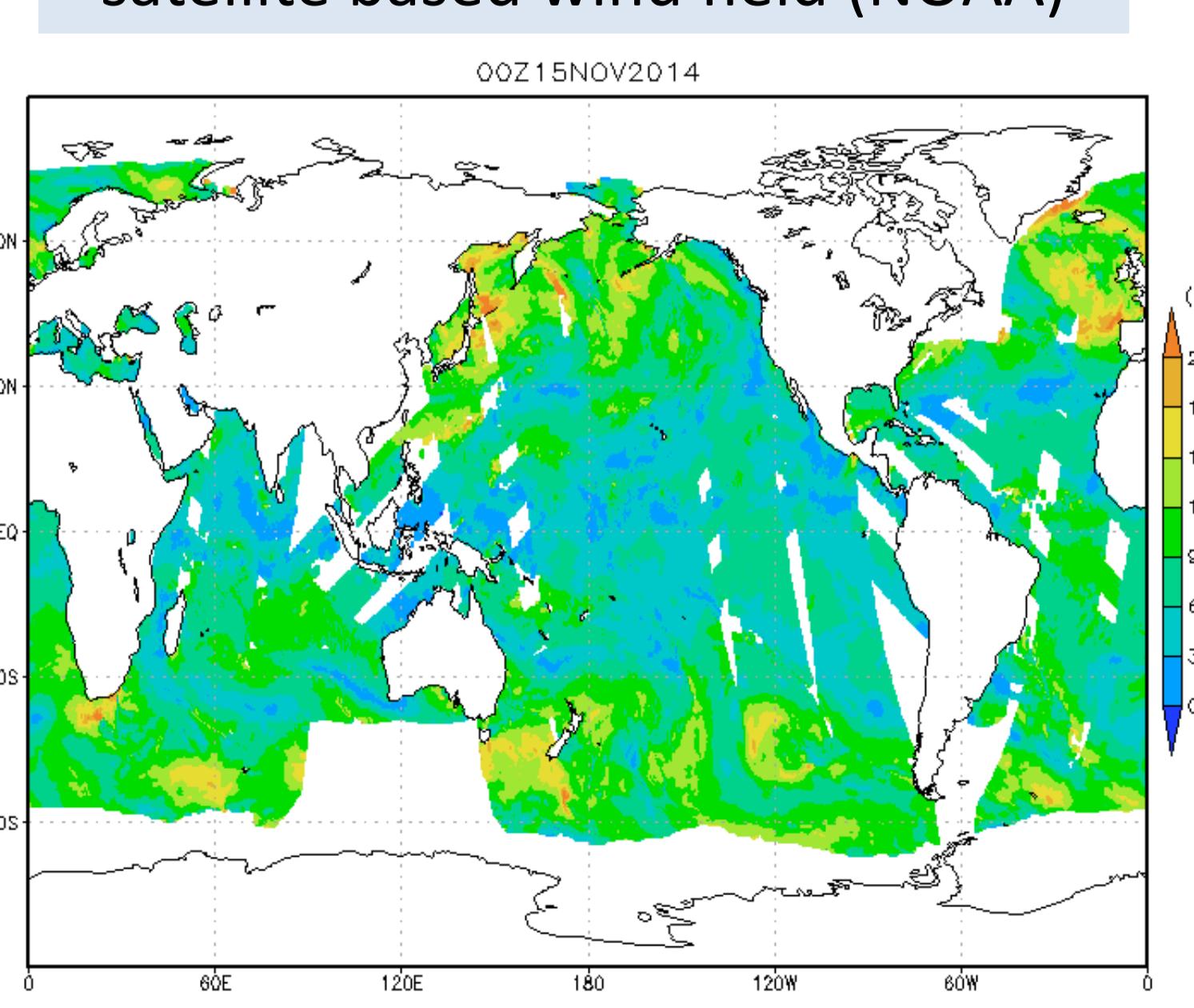
scatter plot



spatial distribution of high gradient area



satellite based wind field (NOAA)



Summary

- Wide swath experimental data were utilized for the assessment of future spaceborne precipitation radar with wide swath observation in terms of the clutter height and strength.
- 90 degree yaw experimental data are very unique and give fundamental information of surface echoes.
- It was confirmed that the surface echo depends on the surface condition (e.g. wind speed).
- These results will help the improvement of rain estimation by spaceborne radar.